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FINAL REPORT

covering the Period

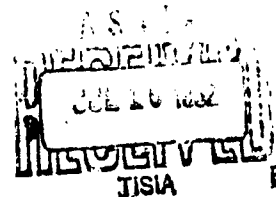
15 February 1961 - 16 February 1962

Title: TREATMENT OF VESICANT BURNS

Prepared By

Roger T. Sherman, M. D.

Date: 30 June 1962



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**Final Report Grant #DA-CML-18-108-61-G-23**

**Treatment of Vesicant Burns**

**Introduction**

Current treatment of vesicant burns of the skin is largely supportive, without specific therapeutic measures available for definitive care. Development of methods for ameliorating some of the incapacity associated with these burns might permit continued combat activity of soldiers with these burns which would be highly desirable. Preliminary investigation of the feasibility of a full scale project aimed at the development of such measures of treatment was the purpose of this grant.

This preliminary investigation included studies of the pathologic anatomy, biologic course and chemistry of vesicant agent burns in human volunteers as possible leads toward the objective stated above. As a result of informal progress reports to the Directorate, Medical Research Division, Army Chemical Corps, support of this work has been continued for the coming year under contract DA-18-108-CML-7113. Transfer of research support from grant to contract requires a final report which is herewith submitted concerned only with preliminary investigations which are not complete and are presently being continued under contract.

**Avenues of Investigation**

A. Chemical constituency of vesicant burn blister fluid. B. Clinical course and pathology of vesicant burns. C. Polymer investigation. D. Standardization of vesicant burn techniques. E. Laboratory facilities.

**Results**

A. Protein components of vesicant burn blebs are different from any other type of blister fluid studied. Most dermatological conditions with blister formation contain fluid in which the protein content is similar to plasma exudate. Cantharide irritation

produces blisters with vesicant fluid protein higher than plasma. Flame burns, of second degree, produce blisters with proteins equal to plasma proteins.

Vesicant burn blister fluid protein is quite high in concentration as indicated in the following example of H blister:

FRACTION	AVERAGE gms/100 cc	PERCENT
ALBUMIN	32.25	81.3
GLOBULIN	7.55	18.6
TOTAL	39.7	100
alpha	1.89	4.2
beta	2.91	7.6
gamma	2.75	6.7

Electrophoresis pattern is included in Appendix I.

A number of vesicant blister fluid samples are in actuality protein gels with the relative protein concentration dependant on hydration which is variable throughout the course of healing of these lesions. Analyses of electrolyte content have not been carried out in a large enough series of burns to generalize, however, it appears that plasma concentrations of sodium and chloride in flame burn blisters are equal to the concentrations of these elements in vesicant blister fluid.

B. Clinical course. A small room set aside for the care and excision of vesicant burns in volunteers has been stocked and equipped and is in use for volunteers. The Responsible Investigator cares for all phases of burn management for volunteers.

Experiments with "Edgewood rods" for transfer to human skin have been carried out on 10 subjects (a total of 12 burns). Full thickness necrosis resulted and in no instance was more than pinhead peripheral vesicles produced. Healing was prompt -

within 10 days without secondary infection. This method is in use for production of burns which are excised for histologic study.

C. Recent experiments with "artificial skin" made from macromolecular polymers have been reported in the literature and the primary investigational emphasis of a possible treatment material for this project is also directed toward macromolecular polymers. Under investigation are polymers of two basic types; polyurethanes and acrylate amide elastomers. A third as yet uncharacterized polymer more suited to polymerization with fluids of high protein content is under investigation.

Interest in mineral (clay) treatment of burns as outlined by the Project Officer for this grant has resulted in intensive study of the Montmorillonite class of adsorptive clay minerals. Bacteriologic study of these materials during the period covered by the grant has included examination of both American and South African clay minerals. There is no significant aerobic contamination of these clays. Anaerobic cultures are still under observation.

The Montmorillonite clays show indication of extreme activity in adsorption of both bacteria and bacterial toxins. In addition, adsorption of large molecular protein compounds is actively accomplished by these clay minerals. Specific protein fractions may well be adsorbed by the clays and current work is being carried out to determine which fractions of whole human plasma protein may be affected. Preliminary results look encouraging in terms of coagulation of proteins in vesicant burn fluids.

D. Standardized burn procedures have been accomplished and a method for routine production in volunteers of vesicant blebs 2 to 3 cm. in diameter is as follows. Transfer of 10 drops of plant run Levinstein to filter paper discs which in turn are held in place over the proposed burned area by dressings for 5 minutes uniformly produce excellent vesicles. Because of the variability of total protein content related to time

postburning electrophoretic patterns serially run are planned.

E. Pilot studies in humans under this grant have been sufficiently productive to warrant continuation of the work under contract, and equipment for chemical blister analysis and electrophoretic studies of blister fluid proteins have been purchased and technical assistance for these determinations is available.

#### Summary

1. A facility for production of vesicant burns, their management, and provision for serial excision in human volunteers has been established.

2. Vesicant blister fluid analysis is remarkably high in protein compared to other vesicles. There is considerable variability in type and amount of protein present at various times after vesication.

3. Preliminary work in the manufacture of macromolecular polymer suited to chemical combination with vesicant blister fluid is in progress. This material might serve as a dressing or definitive treatment which would reduce morbidity from mustard burns.

4. Preliminary investigations of clay minerals as possible adjuncts in burn therapy have established that these minerals can adsorb specific proteins, aerobic organisms, and bacterial toxins. Further investigation of clay minerals seems quite promising at this time.

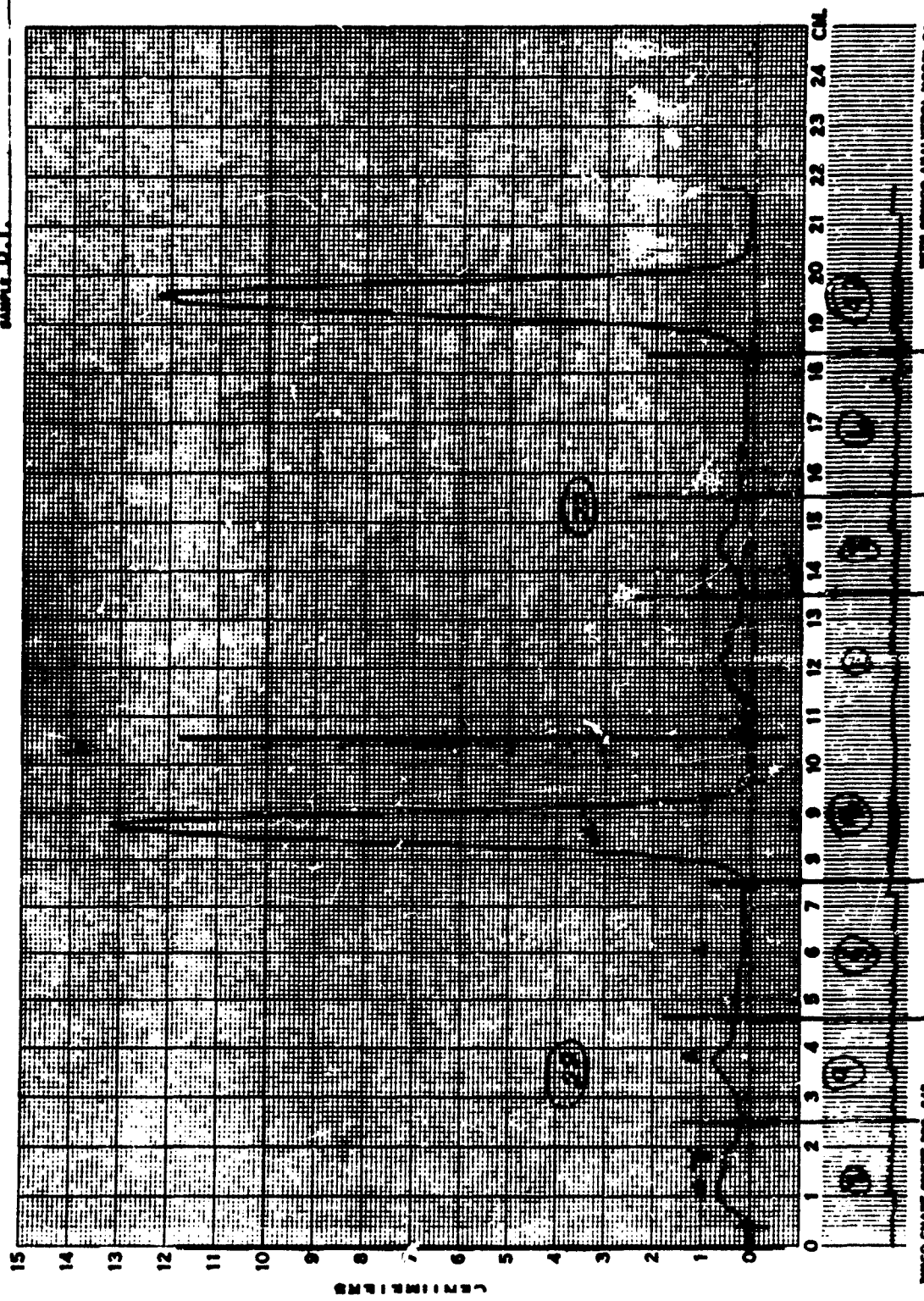
5. Histologic study of serially excised vesicant burns is in progress.

15-70000-1

REMARKS:

APPENDIX

FILTER NO. \_\_\_\_\_  
SLIT WIDTH \_\_\_\_\_  
CAB No. \_\_\_\_\_  
DATE March 1, 1962  
SAMPLE D.I. \_\_\_\_\_



PRICO CHART SHEET 808-543

WITH PRICO ANALYTICAL MODEL 8A  
AND THERMISTOR APPROPRIATE